

**METHODS OF SAMPLING AND TESTING**  
**MT 216-04**  
**METHOD OF SAMPLING AND TESTING CEMENT TREATED BASE**  
*(Montana Test Method)*

**1 Scope:**

- 1.1** This method covers the sampling and testing of: (1) the proposed mineral aggregate to establish a preliminary mix design, (2) the prepared mineral aggregate from the stockpiled material to establish the final mix design, and (3) acceptance samples of the cement treated base aggregate and mixture during construction.

**2 Referenced Documents:**

**2.1 *MT Manual:***

MT-201 Sampling Roadway Materials  
 MT-211 Moisture Density Relations of Soil-Cement Mixtures  
 MT-212 Determination of Moisture and Density of In-Place Materials

**3 Mineral Aggregate:**

- 3.1** The sampling required for the mineral aggregate will be as follows:

- 3.2** *Proposed Mineral Aggregate* – Mineral aggregate from the proposed source must be submitted to the Materials Bureau as part of the pre-construction proposed surfacing package. See MT-201, Sampling Roadway Materials.

- 3.3** *Prepared Mineral Aggregate* - A 300 lb. (136 Kg) sample of the mineral aggregate shall be submitted to the Materials Bureau for the proposed mix design as needed. The procedure is as follows:

- 3.3.1** The stockpile shall be sampled according to MT-201, paragraph 10 - (Stockpile Samples) and then be submitted to the Materials Bureau for the mix design after sufficient quantity has been accumulated to insure a satisfactory average stockpile gradation.

- 3.3.2** Gradation test results of the stockpile and the contractor's Job Mix Target shall accompany the sample.

- 3.3.3** The stockpile average shall be shown on the laboratory work sheet that accompanies the sample.

- 3.3.4** When the sample of mineral aggregate, prepared in accordance with 3.3.1 through 3.3.2, has been received in the Materials Bureau, it will be tested to determine the mix design as follows:

- 3.3.4.1** A moisture-density determination will be made, using the median cement content that was determined in the preliminary investigation.

- 3.3.4.2** Using the optimum moisture and maximum density as determined in AASHTO T134, a 7-day and a 28-day compressive specimen and a freeze-thaw and wet-dry specimen will be molded for each of three cement contents (one cement content will be at the median, one at 1% less than median, and one at 1% more than median).

- 3.4** At the conclusion of the testing described in 3.3.4, a mix design will be established consisting of:

- 3.4.1** The optimum moisture content,

### 3 **Mineral Aggregate:** (continued)

3.4.2 The maximum density,

3.4.3 The recommended cement content, (% of cement by wt. of dry aggregate)

3.4.4 Minimum 7-day compressive strength requirement.

### 4 **Acceptance:**

4.1 After a satisfactory mix design has been established and construction has begun, the following sampling should be accomplished:

4.1.1 **Cement Content Determinations.** After the contractor has succeeded in producing a uniform mixture of the cement treated base, a sample will be tested for cement content. It is necessary to have the following samples to determine cement content:

4.1.1.1 A sample of cement used in the mixture.

4.1.1.2 A sample of the mineral aggregate before the addition of the cement. This sample shall be marked "Mineral Aggregate for Cement Content."

4.1.1.3 One of the 7-day compressive specimens. After the compressive strength has been determined the specimen will be pulverized in the Materials Bureau and used as the sample of the mixture for the cement content determination.

4.1.2 *In-Place Densities* - In-place densities will be determined in accordance with MT-212. A corrected moisture curve must be established by correcting the nuclear moisture reading to oven-dry moisture contents.

4.1.3 *Field-Made Compression Specimens* - A minimum of one set of specimens per two-lane mile per lift shall be molded in accordance with paragraph 4 described below. It is desirable that these specimens represent the material placed at the locations of the in-place densities in order that moisture-density comparisons can be made. One specimen will be tested as a 7-day compression specimen and the other as a 28-day compression specimen. The Materials Bureau will supply shipping boxes and blank forms to accompany samples. A copy of the form to accompany specimens will be placed in the plastic envelope in the shipping box and a copy mailed to the Materials Bureau.

4.1.3.1 Additionally, after the plant is producing satisfactorily, wet-dry and freeze-thaw cylinders are required. One set (2 cylinders per test) shall accompany a set of compressive strength specimens.

4.1.4 *Acceptance Samples of Mineral Aggregate* - Acceptance samples for gradation analysis shall be taken in accordance with contract specifications. See MT-601 - "Aggregate, Cement Treated Base, When Used."

### 5 **Molding Specimens in the Field:**

5.1 Specimens shall be molded in the field and shipped to the Materials Bureau for compressive testing as follows:

5.1.1 The material to be molded shall be the mixture of CTB placed on the roadway. It must be transported to the place of molding as quickly as possible in order to minimize hydration. (Excessive hydration can reduce the lubrication properties and result in less than maximum density

and therefore lower strengths.)

**5 Molding Specimens in the Field:** (continued)

**5.1.2** The apparatus shall be the same as described in MT-211. (Moisture-Density Relations of Soil-Cement Mixtures).

**5.1.3** Form a specimen by immediately compacting the mixture in the mold, (with the collar attached) and later trimming the specimen in accordance with Section 7.2 in MT-211, and in addition:

**5.1.3.1** Spade along the inside of the mold with a spatula as the mixture for each layer is placed in the mold and before compaction, to obtain uniform distribution of the material retained on the 4 Mesh (4.75 mm) sieve.

**5.1.3.2** During compaction, obtain a representative sample of the mixture, weighing not less than 500 grams. Weigh the sample immediately and dry in an oven at 230 ° 9°F (110 ° 5°C) at least 12 hours or to constant mass to determine the moisture content as a check against design moisture content.

**5.1.3.3** Weigh the compacted specimen to check against design density and permit to cure for 24 hours. (Note 1)

*Note 1 - During the initial curing period, the specimen must be kept damp and maintained as nearly as possible at a temperature of 73.4 ° 3°F (23 ° 1.7°C).*

**5.1.4** In the same manner form a second specimen as rapidly as possible. One specimen will be identified as a 7-day compression specimen, the other a 28-day compression specimen. Also wet-dry and freeze-thaw specimens may be made as indicated in 4.1.3.1. (Note 2).

*Note 2 - A satisfactory method of identifying the specimens for the 7-days or 28-days, of curing in the moist room, is to wrap a piece of masking tape around the specimen. Indicate on the masking tape the making date, stationing lane, type of test, etc. Allow sufficient space for the Materials Bureau to show the laboratory number and the breaking date.*

**5.1.5** At the conclusion of the initial curing period, place the compressive specimens and the wet-dry and freeze-thaw specimens in the shipping box, packed in damp sawdust, and transport to the Materials Bureau as soon as possible in order that final curing can be accomplished in the approved curing room.